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VOL A

INSTRUCTIONS
FOR
AC CONVERTER
MODEL 0020

DANA™

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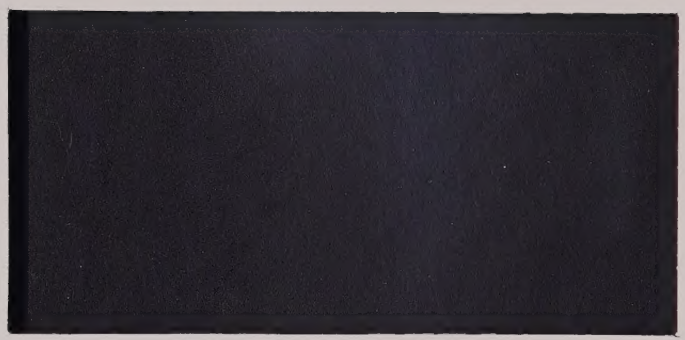

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INTRODUCTION

The Dana Model 0020 AC Converter is a signal conditioning plug-in circuit card for use with Dana Series 4000 or 5000 Digital Voltmeters (DVM's). When installed in a DVM which is properly wired, it allows AC voltages to be measured with the normal voltmeter leads. The 0020 is contained within and derives its power supply voltages from the DVM. The guarded input characteristics of the Dana DVM are retained for AC measurements. Full resolution of the DVM is available for AC measurements including the 1 volt full scale range.

SPECIFICATIONS

Model 0020 - Dana AC Converter

Function	Converts AC voltage into proportional DC voltages, which are measured by the DVM; all specifications refer to output of DVM as a function of AC voltage input
Frequency Range	10 cps to 50,000 cps
Voltage Range	500 volts RMS or 750 volts peak; 10 cps to 2.5 KC; 125 volts RMS or 180 volts peak; 2.5 KC to 10 KC.
Full Scale Ranges	1; 10; 100; 1000 volts full scale
Calibration	RMS for sine wave input; 1.11 times full wave average magnitude for other wave forms
Dana Certification	Sine wave
Certified Accuracy	50 cps - 1000 cps; 0.1% of reading or 0.02% of full scale of range, whichever is greater; 1000 - 10,000 cps; 0.2% of reading or 0.03% of full scale of range, whichever is greater
Typical Accuracy	10 - 50 cps: 1% of reading or 0.2% of full scale of range, whichever is greater; 10 KC - 50 KC: 1% of reading or 0.1% of full scale of range, whichever is greater
Range Control	Automatic with manual override selected by knob on DVM front panel
Decimal Point Indication	Automatic
Measuring Time	DVM DC measuring time plus two seconds without range change; five seconds worst case with automatic range selection

Input Impedance	1 and 10 VFS ranges: 1 meg with less than 150 pfd shunt; 100 and 1000 VFS ranges: 5 meg with less than 130 pfd shunt. (exclusive of external input cable)
Isolation	AC input is isolated and guarded from ground, the AC power line, electrical output
Size and Mounting	AC converter is enclosed entirely within Dana Series 4000/5000 DVM (5 1/4" high EIA rack); there are no additional cables, connectors, or controls
Card Location	Address 24
Color Code	Red/Yellow

DESCRIPTION

The Model 0020 AC Converter is an all solid state circuit card that accepts an AC signal and converts it to a DC voltage which is measured by the DVM. When used in a Dana Series 4000 or 5000, highly precise AC measuring capability is provided with automatic range selection.

The converter is essentially an AC amplifier with precise gain followed by a full wave rectifier and a low pass filter.

The converter senses the average value of the waveform and scales the output to indicate the RMS value of a sine wave.

Because the converter must present a stable and precise DC output, the output is well filtered; the time constant of the converter is a result of this filtering.

OPERATION

When the Model 0020 is installed in a Dana DVM, full AC measuring capability is available using the normal input leads. Basically, operation of the DVM for AC measurements is the same as for DC measurements, since the normal guarded input circuit is utilized, and all automatic features are available.

Referring to Figure 5.1 of the basic DVM manual, the Function switch is placed in "AC Volts". The Range switch may be either on one of the manually selected ranges or in "Auto".

Some care should be taken to select the correct Mode position. For most measurements, the "Tracking Auto Threshold" mode should be used. This allows the DVM to track any significant change in voltage with new readings as often as 5 times per second.

When the "Tracking Auto Threshold" mode is used and a range change occurs, an internal delay allows the filter to settle to full accuracy before a new reading is taken.

If the "Command" mode is used, care must be taken that the filter has settled before a reading is made. The input must be connected for at least two seconds before a command is given, if full accuracy is to be realized. The "Command" mode may be used with automatic ranging since the internal delay prevents a reading from being taken until a fully accurate measurement can be made. Range changes, of course, increase the time to make a reading.

STANDARDS LABORATORY CALIBRATION PROCEDURE FOR DANA AC CONVERTER, MODEL 0020

Equipment Required:

AC signal source, 50 cps to 10 kc, 0-500.00 volts RMS ± 0.03% with distortion of less than 0.03%.

Dana DVM Extender Card assembly part #400035 and converter input extender cable, (supplied with extender kit part #400913).

1.0 With the DVM power OFF, insert the converter with extender card, support bracket, and extender cable into the DVM. The door should be braced far enough open to keep it from shorting against the back of the extended unit.

1.1 Turn the power on and allow the voltmeter to warm up 10-20 minutes.

2.0 Threshold Adjustment

2.1 Place the Function switch to AC volts, "Range" to 10, and "Mode" to "Periodic".

2.2 Set DVM to its 10 volt range. Set the Input accurately to 10 millivolts at 400 cps. Adjust R1 to read 10.0 mv.

3.0 AC Calibration

For optimum performance, the following procedure should be followed in the exact order described. Many adjustments are interacting and, if the order is changed, it will be impossible to complete the calibration. For all of the following steps, the meter should be connected to the AC source as in Figure 1.

3.1 10 Volt Range

3.1.1 Place the "Range Selector" to "10", apply 400 cps at 9.0000 ± 0.0027 volts RMS to the meter. Retain this voltage level for each frequency called for in the 10 volt range.

3.1.2 Adjust R2 (Figure 2) for a readout of 9.0000 on the meter.

3.1.3 Apply 10 KC and adjust C1 (Figure 2) for a readout of 9.0000 also.

3.1.4 Repeat 3.1.1, 3.1.2, and 3.1.3 to assure proper balance between the two adjustments.

3.1.5 Apply 50 cps, 3 KC, 5 KC, and 8 KC and observe readouts to varify response.

3.2 1.0 Volt Range

3.2.1 Place the "Range" selector to 1 and set the frequency to 400 cps at 0.90000 ± 0.0027 volts RMS. Retain this voltage level for each frequency in the 1.0 volt range.

3.2.2 Adjust R3 (Figure 2) for a readout of .90000.

3.2.3 Set frequency to 10 KC and adjust C2 (Figure 2) for a readout of .90000.

3.2.4 Repeat 3.2.1, 3.2.2, and 3.2.3 for a proper balance between the two adjustments.

3.2.5 Apply 50 cps, 3 KC, 5 KC, and 8 KC and observe readouts to verify proper response.

3.3 100 Volt Range

3.3.1 Switch "Range" to "100" and set the frequency generator to 400 cps. For the first adjustment, the input level will remain at 0.90000 volts RMS.

3.3.2 Jumper TP1 and TP2 (Figure 2) and observe the readout. Change the input frequency to 10 KC. Adjust C3 to achieve the same reading as observed at 400 cps. Repeat the step to assure balance. Remove the jumper.

3.3.3 Set the input to 400 cps 90.000 ± 0.027 volts RMS. This voltage level should be kept throughout the rest of the 100 volt range adjustments.

3.3.4 Adjust R4 for a readout of 90.000.

3.3.5 Change the input frequency to 10 KC and adjust C4 for a readout of 90.000.

3.3.6 Change the input frequency to 5 KC. Adjust C5 to read 90.000.

Because of the interaction between C4 and C5, paragraphs 3.3.5 and 3.3.6 may have to be repeated several times before both readings balance. To keep calibration time to a minimum, after C4 has been adjusted to read 90.000 and the input set to 5 KC, observe the readout. Determine the number of digits difference between this value and 90.000. Adjust C5 to twice this number of digits past 90.000 and then readjust C4 to 90.000 at 10 KC. Repeat this, if necessary, to achieve a balance.

3.3.7 Apply 50 cps, 3 KC, and 8 KC and observe the readouts to verify proper response.

3.4 1000 Volt Range

3.4.1 Set the input to 10 KC at 125.00 $\pm$ 0.037 volts RMS.

3.4.2 Adjust C6 for a readout of 125.00.

3.4.3 Set the frequency to 50 cps, 3 KC, 5 KC, and 8 KC and observe the readouts. These readings are dependent on the proper adjustments of the first three ranges and if C6 fails to bring the instrument within the specified tolerance on the 1000 volt range, the lower ranges will require readjustment.

3.4.4 Some interaction may be observed between C3 and C6. After calibrating the 1000 volt range, check the 10 KC response on the 100 volt range and readjust if necessary (paragraphs 3.3.1 through 3.3.7). If readjustment was necessary, the 1000 volt range should be recalibrated (paragraph 3.4).

3.5 Final Check

Because of the sensitivity of the AC Converter to stray capacitance, there may be some error at high frequencies in the two high ranges when the converter is installed in the DVM. After the converter has been inserted in the DVM, observe the readout with the input set to 90.000 $\pm$ 0.027 volts and the frequency set to 10 KC. Record the reading and replace the converter on its extender card. With the input remaining at 90.000 volts and 10 KC, adjust C4 to read 90.000 plus or minus the difference in the two readings (reading with card on extender and reading installed). If the "installed reading" was in the negative direction, set C4 to read the same amount in the positive direction and visa versa. When the converter is reinstalled in the instrument, the error should be corrected.

1. 50 CPS TO 10 KC
2. 0-500.00 VRMS ± .03%
3. DISTORTION < 0.03%

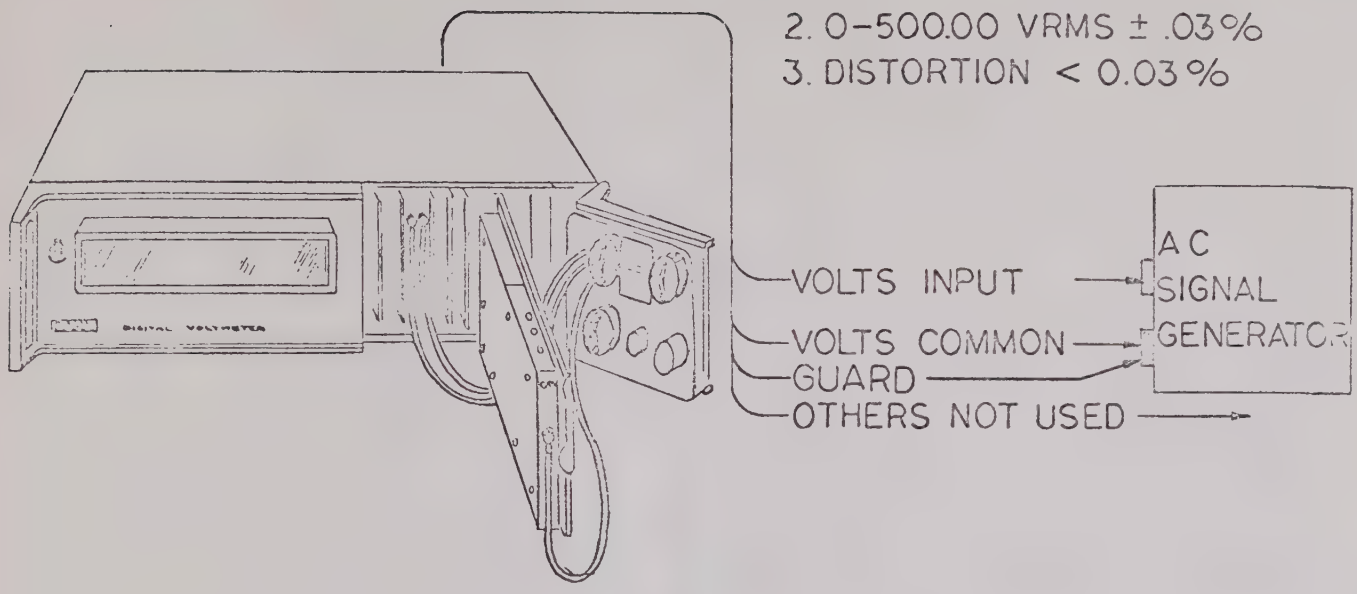


FIGURE - 1

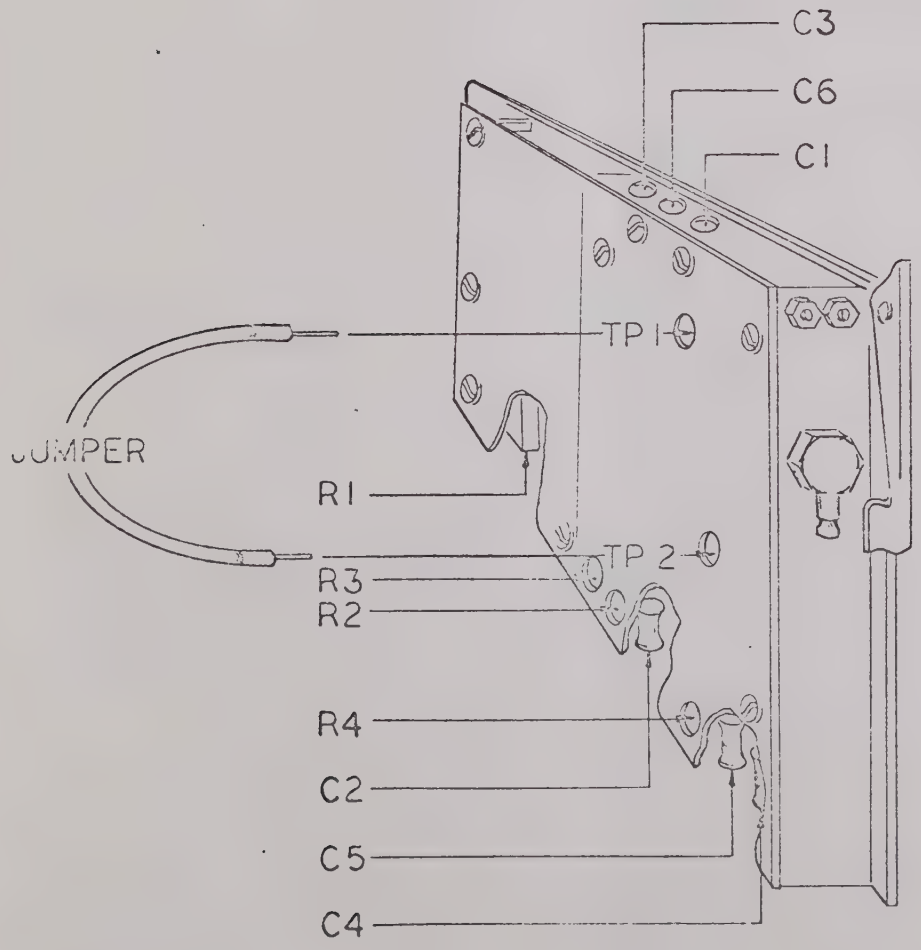
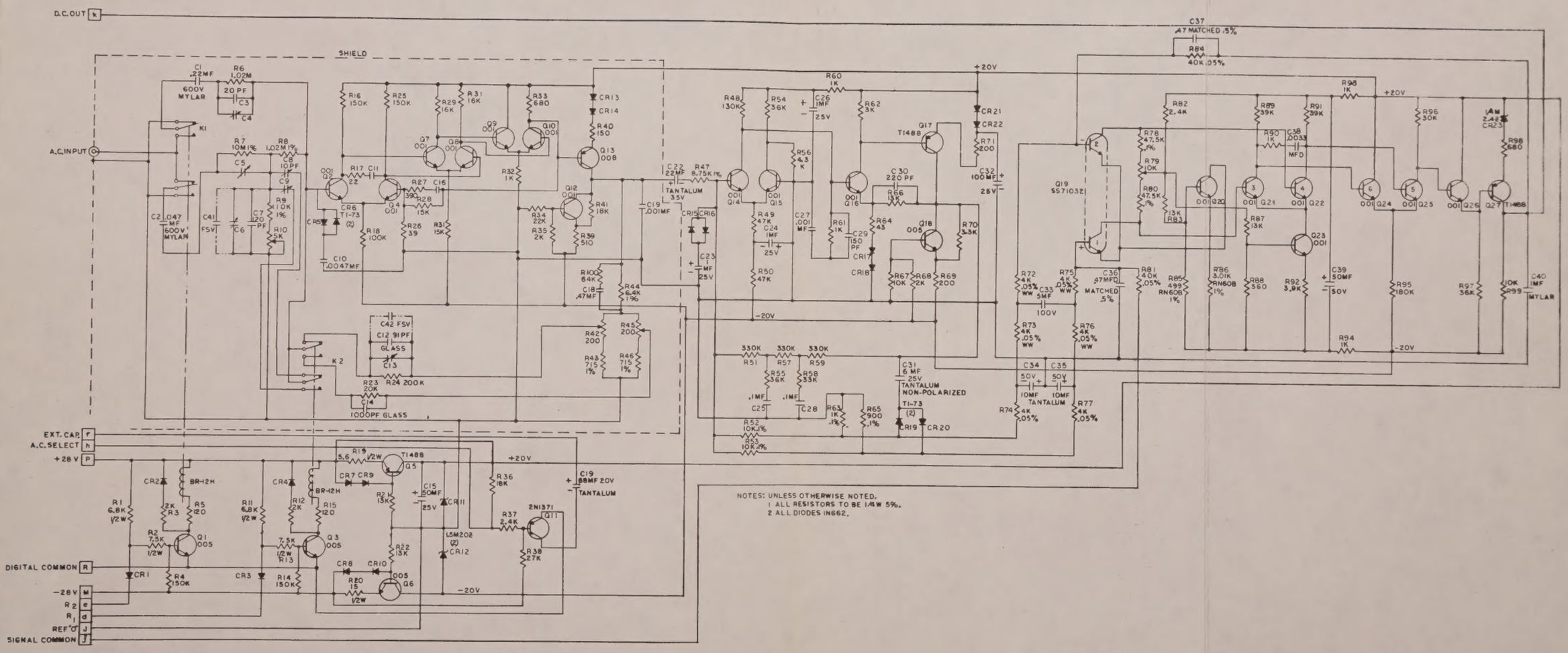
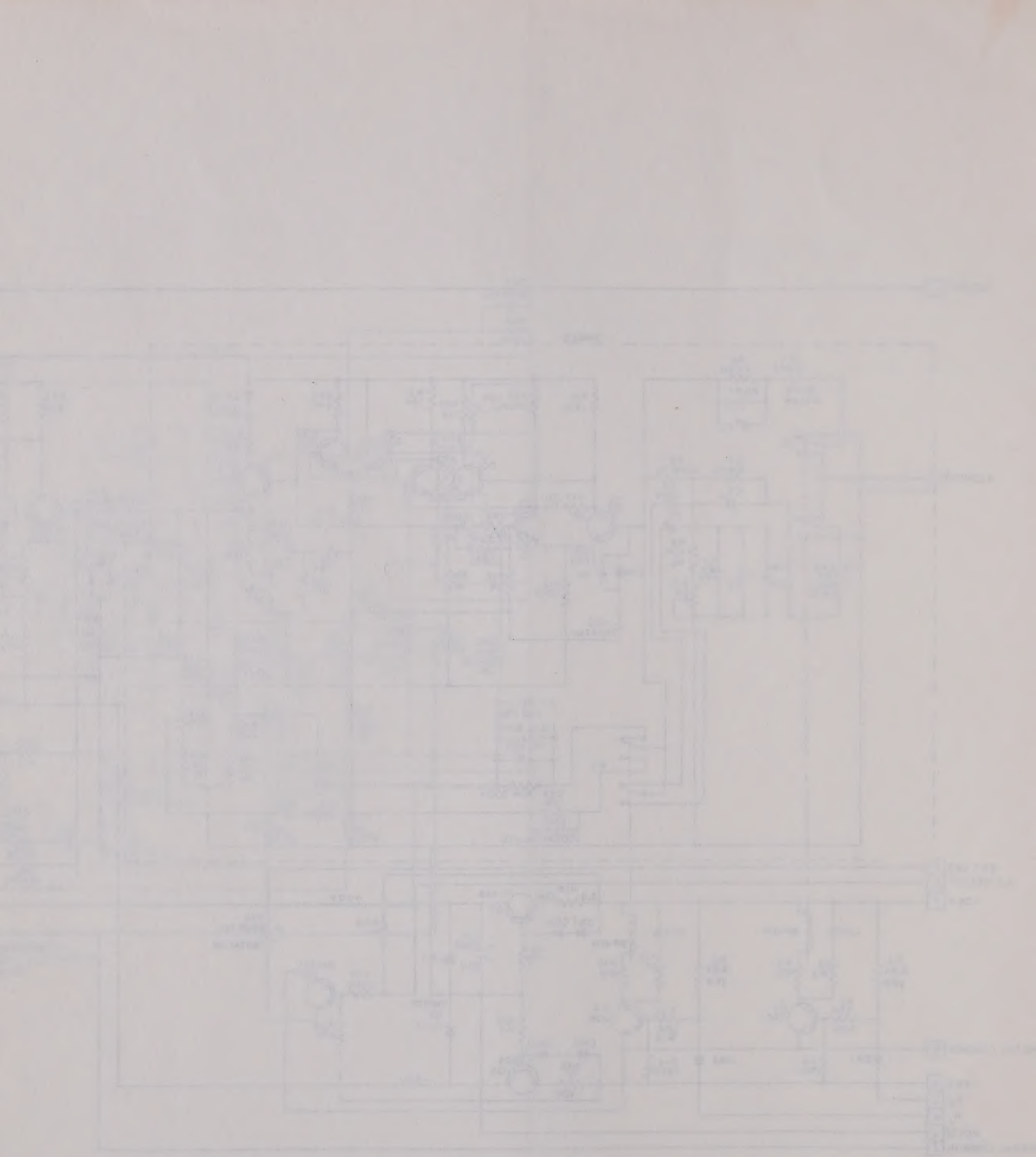


FIGURE - 2


D.C. OUT k
A.C. INPUT
SHIELD
EXT. CAP. f
A.C. SELECT h
+28 V p
DIGITAL COMMON R
-28 V m
R2 e
R1 d
REF'D J
SIGNAL COMMON j
+20V
-20V
NOTES: UNLESS OTHERWISE NOTED.
1 ALL RESISTORS TO BE 1/4W 5%.
2 ALL DIODES IN662.



MP MASTER
MA31058